Evaluation of some plant powders for control of *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae)

تقييم كفاءة بعض مساحيق النباتات للسيطرة على خنفساء اللوبياء *Callosobruchus maculatus* F. (Coleoptera: Bruchidae)

Nawal S. Mehdi
Department of Biology, College of Education Ibn- AlHaitham, Baghdad University.

ABCTRACT:

The study was undertaken to evaluate the effect of six plant which *are :Eugenia carayophyllata , Piper nigrum, Ocimum basilicum, Cuminum cyminum, Allium sativum, Mentha pipertia*
powders against *Callosobruchus maculatus* (F.) in*Vigna sinesis* (cow peas) and the physiological quality of the treated seeds under laboratory condition. Among the plant powders tested *Eugenia caryophyllata* Thunb. Floral buttons and *Piper nigrum* L. seeds which recorded percentage of oviposition deterrence and percentage reduction in F_1 adults as 100 and 84.2% respectively and the feeding deterrent index and seedling percent of plantlets from seeds treated with these powders were 91.78, 78 and 28, 39.6 respectively. So, these powder, achieved satisfactory efficiency. However seeds treated with fruits powders of *A. sativum* and leaves powders of *M. piperita* and control treatments showed seedling percents as 64, 54.6 and 54.6 respectively.

الخلاصة:

تناولت الدراسة تقييم كفاءة مساحيق ست نباتات هي *Eugenia carayophyllata , Piper nigrum, Ocimum basilicum, Cuminum cyminum, Allium sativum, Mentha pipertia* على بذور اللوبيا (cow peas) *Vigna sinesis*، ودراسة فعالية البذور بعد المعاملة في ظروف المختبر. من بين مساحيق النباتات المستخدمة مسحوق براعم ازهار القرنفل *Eugenia caryophyllata*، ومسحوق بذور الفلفل الاسود *nigrum* وعند معاملة البذور به سجل معامل منع وضع البيض ومعامل خفض بزوغ بالغات الجيل الاول 100و 84.2% على التوالي وكان معامل منع التغذية 91.7 و78.8 ونسبة انبات البذور المعاملة 28 و 39.6 على التوالي، لذا فان هذين النباتين ذوا كفاءة عالية في حماية البذور من الاصابة ولكن معاملة البذور بمسحوق الثوم *Allium sativum* ومسحوق اوراق نبات النعناع *Mentha pipertia* ومعاملة السيطرة اظهرت نسبة انبات للبذور 64 و54.6 و54.6على التوالي.

INTRODUCTION

Bean beetles *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae) are agricultural pest of Africa and Asia that presently range throughout the tropical and subtropical world. This species also known as the southern cowpea weevil. The larvae of this species are feeding and developing exclusively on the seed of legumes (Fabaceae) hence the name been beetle (1) bringing poor quality and consuming embryo nutrient reserves and consequently producing seed low germination and weak plantlets (2). Indeed *C. maculatus* infestation on stored legumen may reached 50% within 3-4 month of storage (3). The control of this pest has been accomplished in wide scale with fumigants and residual insecticides both of which can pose serious hazards to warm-blooded animals and environment. Natural product as well known to have arrange of useful biological properties against pests (4).

Botanical insecticides are of great interest to many because it is natural insecticides, toxicant, derived from plant. Historically the plant materials have been in use longer than any other group. Pyrethrum, derris, tobacco camphor and turpenetine were some of the move important plant products in use before the organized search for insecticides began, the use of leaves and seeds of

herbs in the pest control of stored been and corn in common practice among small farmers, Bioactive compound kill, repel, inhibit oviposition and reduce larval development, fecundity and adults fertility (5).

The objective of this work was to evaluate the efficiency of six plant species on the survival, adult oviposition and emergence of *C. maculatus* which is an important pest that attack *Vigna sinensis* and the efficiency on seeds physiological quality of beans treated with plant powders.

MATERIALS AND METHODS

1- Rearing of experimental insects:

Laboratory culture of *C. maculatus* was established in July 2010 from infested seeds obtained from college of science for woman university of Baghdad. The stock culture of the insects maintained on *Vigna sinensis*, seeds to obtain newly emerged pulse beetles of same generation, 25 insects were released in plastic containers having 250 of cowpea seed covered by muslin cloth, containers kept in acclimatized chambers at 28 ±2 C° and 65 ±5% humidity, after one week adults were removed and egg laid seeds were maintained at required temperature and humidity. The insects emerged after four weeks were used in entire investigation. Insect eggs counted by using hand lens (6).

2- Preparation of plant powders:

Fresh leaves of *Mentha piperita* and *Ocimum baslicum* fruits of *Piper nigrum*, *Allium sativum*, *Cuminum cyminum* and flower buds of *Eugenia caryophyllata* were selected to evaluate

against *C. maculatus* Table (1). The control consisted of feeding substratum only. Some plant materials (seeds) collected from local markets, leaves plant material was dried under shade, all powdered by electric grinder and pass thought a 40 mesh sieve and kept in glass containers at room.

3- Biological assays:

Plant powders were added separately to (weighted) 25 seed of *Vigna sinensis* in plastic containers (3.5 cm diameter x 7.5 cm high) at 2.5% w.w, mixed gently, the control consisted of seeds only. A completely randomized design with three replicates was used for each plant powder and control, two pairs of *C. maculates* adults with 1-24 hours of age were introduced in each container (5). After five days dead insects removed, eggs were counted.

Percentage of oviposition deterrence (POD) was calculated as POD= T_s- C_s/ C_s × 100 (T_s = Number of eggs laid on treated, C_s = Number of eggs laid on control) according to (8). After the eggs were counted the experiment set up was kept undistributed till the emergence of F_1 adults from the treated seeds.

After 30^{th} days: The number of F_1 adults emerged from the control seeds (A_c) and treated seeds (A_t) were recorded. The percentage reduction in F_1 adults (PRA) was calculated as: PRA: A_c- A_t/ A_c × 100 (8).

To evaluate the efficiency of the treatments on the physiological quality of seeds, its weight were recorded after 30 days, then seed sowed and convert with a thin cotton layer in plastic trays (19 cm× 25 cm ×3 cm) wetted by tap water, left for 7 days, after sowing, daily recording the number of emerged seeds (plantless showing totally free cotyledons) until the seventh day to calculate seedling percent. Percent in weight loss were determined (7). Feeding Deterrent index (FDI) were calculated due to:

FDI= (Weight loss control – Weight loss in treated/ weight loss in control × 100). (6)

4- Data Analysis: The data obtained from the experiments were subjected to two-way analysis of variance (ANOVA).

RESULTS AND DISCUSSION

Many literature indicate the importance of plant extract in protecting seeds by way of direct mixing of dried leaves plant powdered, solvent extracts, vegetable, essential oil on seeds during post harvest storage (8, 9, 10).

Present study revealed that maximum oviposition deterrent completely prevented the female lying, so the number of laid eggs was zero and the POD was 100%. *O. basilicum* and *C. cyminum* had same deterrent activity which was 71.1 and 70.7 respectively, whereas the lowest POD recorded when seeds mixed with *P. nigrum* powder (59.5) (Table 2). Oviposition deterrence may be due the changes induced in physiology and behavior in adults of *C. maculatus* as reflected by their egg laying capacity. This argumentation jointed those of Aboua *et al.* (2010) (11).

Our results agree with De Sousa *et al.* (2005) (2) studying the effect of seven plant powders against *C. maculatus* in *V. unguiculata* seeds found that the *E. caryophyllata* and *P. nigrum* reduced ovipostion in 100% and adult emergence in 100% too. They believed that their efficiency can be related to the repellent effect of their volatile compounds which might cause sterility in males as well as in females, the data shown in table (2) revealed too the effect of plant powders on adult's emergence of pulse beetle.

A significant reduction in adult emergence was among all treatment and control. Maximum percentage reduction in adult emergence was observed in seeds treated with *E. caryophyllata* and *P. nigrum*, PRA recorded was 100 and 84.2 respectively. Mean while adult emergence percent and PRA was 69.6 and 23.5 respectively when seeds treated with *M. piperita* powder. This finding obviously indicate that this powders effect on postembryonic survival of insects and resulting reduction in adult emergence, which in agreement with (12, 13, 14) who reported that various plant were effective in reducing oviposition and adult emergence of *C. maculatus*. The reduction in adult emergence could either be due to egg mortality or larval mortality or even reduction in the hatching of the eggs (6).

Another findings of this study (Table 3) indicate the repellent and deterrent effects of the plant powders used of feeding of *C. maculates*. In Table 3 results showed that losing weight percent in seeds 1.65, 4.14 and 8.8 when the seeds treated with *E. caryophyllata*, *P. nigrum* and *C. cyminum* respectively, and FDI values were 91.7, 78.8 and 54.6 respectively, mean while the percent lost in seeds weight in control was 19.4% and FDI was zero. Results also showed that those plant powders somehow protected the seeds from infestation of bruchids, so there were little losing in seeds weight in comparison with the control treatment.

Emergence of plantlets percent derived from seeds treated with powders of *C. cyminum*, *A. sativum* were 89.3 and 64 respectively mean while the control treatment was 54.6% the fact that plantlets derived from seeds treated with some plant powders did not emerged is certainly related to the serious infestation of *C. maculatus* in the treatment in which there was no control for insect laying eggs, so that larvae hatched from these eggs penetrate the seeds feed and survive (15).

The results agree with Myers (1995) (16) who mentioned that the larvae penetration in the seeds, development and feeding on the cotyledon occur before adult emergence which causes decrease of germinative capacity. In conclusion, admixing the powder of *E. caryophyllata* and *P. nigrum* may be recommended as cheap, easily available and may provide suitable alternative to the synthetic insecticides for small-scale farmers in rural environment in management of *C. maculatus*.

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Table (1): Plants used in the study.

Plants	Family	Common Name	Part Used
Eugenia caryophyllata Thunb.	Myrtaceae	Clove	Floral buttons
Piper nigrum L.	Piperaceae	Black pepper	Seeds
Ocimum basilicum L.	Labiate	Basil	Leaves
Cuminum cyminum L.	Umbellifera	Cummin	Fruits
Allium sativum L.	Liliaceae	Garlic	Fruits
Mentha piperita L.	Labiate	Peppermint	Leaves
Vigna sinensis	Leguminosae	Cowpea	Seeds

Table(2): Insecticidle action of plant powders against *C. maculatus* in *V. sinensis*.

Plants	No. Egg/ 25 seeds ± SE	POD	Adult Emergence% ± SE	PRA
E. caryophyllata	0.0 ± 0.0	100.0	0.0 ± 0.0	100.0
P. nigrum	26 ± 37.4	59.5	14.3 ± 24.6	84.2
O. basilicum	48.6 ± 33.1	71.12	42.3 ± 23.9	53.5
C. cyminum	49.3 ± 4.3	70.7	32.6 ± 25.6	64.1
A. sativum	54.3 ± 18.2	67.7	51.3 ± 8.0	43.6
M. piperita	99.6 ± 4.1	68.9	69.6 ± 1.3	23.5
Control	168.3 ± 16.3	0.0	91.0 ± 10.5	0.0

POD= Percentage of Oviposition Deterency
PRA= Percentage of Raduction in F_1 Adults

Table (3): Physiologic analysis of the treated seeds with plant powders.

Plants	Weight of 25 seeds/gm ± SE	% Loosing weight ± SE	FDI %	% seedling ± SE
E. caryophyllata	6.7 ± 0.01	1.65 ± 3.6	91.7	28.0 ± 15.4
P. nigrum	6.7 ± 0.04	4.14 ± 2.9	78.8	39.6 ± 14.4
O. basilicum	6.8 ± 0.07	10.2 ± 4.8	47.4	52.0 ± 12.3
C. cyminum	6.6 ± 0.06	8.8 ± 0.9	54.6	89.3 ± 14.1
A. sativum	6.8 ± 0.04	14.6 ± 2.9	24.7	64 ± 16.3
M. piperita	6.6 ± 0.07	18.12 ± 4.0	6.70	54.6 ± 15.6
Control	6.5 ± 0.03	19.4 ± 5.9	0.0	54.6 ± 8.8

FDI= Feeding Deterring Index